TERRACES AND WATER AND SEDIMENT CONTROL BASINS

This procedure applies in general to all terraces and water and sediment control basins (WASCB's) whether used as a single practice or in combination with other practices as components of a total system. This includes when grassed waterways and/or underground outlets are used as the outlet for a terrace or WASCB.

Practice Standard 600 has criteria for the design of a terrace. Practice Standard 638 has criteria for the design of a WASCB. The Engineering Field Handbook (EFH), Chapter 8, has guidance on planning, design, layout, construction, and maintenance of terraces. This chapter is also applicable to WASCB's. Practice Standard 600 and 638 require that areas that are not farmed will be established to suitable erosion-resistant vegetation or protection according to Practice Standard for Critical Area Planting (342) and Practice Standard for Mulching (484).

Before Construction

A. Job Investigation

1. Ask the landowner about recent or future chemical usage at site.
2. Is site adaptable to terraces or WASCB's?
3. Suitable outlet - existing or to be constructed (natural, grassed waterway, or tile outlet).
4. Watershed size, slope, and land use.
5. Soils.
6. With the landowner, determine purpose, type, shape, whether terrace or WASCB, present any future farming operations, size of equipment, spacing, and shape of channel. Will they be farmed? Will it fit in with farming operations? Is there a need for equipment crossings such as at end rows?
7. Type of layout - improved alignment, parallel.
8. Shape of ridge - Broadbase, grass backslope, or narrow base.
9. Shape of channel - Vee, trapezoidal, or parabolic.
10. For grass backslope and narrow base, can vegetative protection be established (need for topsoiling, fertilizer, lime, mulching, or riprap)?
11. Legal problems, such as outletting tile in road ditch or county tile.
12. Buried or above ground utilities.
13. Alternative structure, treatment, or management measures and complimentary conservation practices.
14. Determine if borrow areas for fill are needed.
15. Engineering job class.
16. Operation and Maintenance Plan.
17. Cultural Resources form CPA-052.

B. Layout and Survey

1. For terraces and WASCB's where drainage areas are small, topography is reasonably uniform, elevations with respect to other structures are not important, the alignment is parallel, design tables are available, and underground outlets are used the survey notes should follow Technical Release No. 62 standard format for engineering notes for terraces, Figure 2-4, pages 2-26 and 2-27. Survey notes are to contain the following information:
    a. Sketch showing location of terrace or WASCB lines, and tile lines to an outlet. Show legal description of field.

b. Significant characteristics in the field area such as culverts, road crossings, fence crossings, waterways, or other items that may affect the flow or construction of the terrace or WASCB. Indicate outlet.
c. Centerline profile to determine stable channel grade to outlet. Begin with your key terrace. Mark your flagline or stakeline usually a fixed distance upstream from the ridge such as 15 or 30 feet. Take a centerline elevation shot at least every 100 feet along the proposed terrace or WASCB. Take a profile along any proposed tile lines used for outlets of the terraces or WASCB's.
d. Survey cross sections. Use survey stations at least every 50 feet for storage structures. Survey stations should be at least every 100 feet for gradient terraces to waterway outlets.
e. Outlet information.

2. More complex layouts or where the topography is very irregular may require a topographic survey to be made. A topographic survey can be obtained by taking more cross sections and extending them through the storage area to a minimum of 2 feet above the design top elevation.
3. For guidelines on the surveys of complimentary conservation practice installations, refer to the appropriate Minnesota Engineering Procedure.

C. Design

1. Design terraces in accordance with Practice Standard 600 and design WASCB's in accordance with Practice Standard 638 found in Section IV of the Technical Guide. Approved design charts and tables are found in EFH Chapter 8.
2. Design information will be shown on worksheet MN-ENG-46 for graded terraces. Computer printouts and drawings similar to those shown on the above worksheet can be used instead. Design information can be shown in the field notes in lieu of using the above worksheet. Additional field note sheets will be used as necessary to show equivalent information to that on the MN-ENG-46 worksheet. These field notes or the MN-ENG-46 worksheet can be considered the plan for small jobs. When the design is shown in the field notes or on a computer printout, the added drawing to this shall contain as a minimum:
   a. A plan view superimposed on the location showing terraces, WASCB's, or underground outlets identified by numbers or letters.
   b. A typical cross section of ridge and channel showing existing and design elevations.
   c. A profile and alignment for storage terraces or storage WASCB's. A profile of the underground outlet and intakes with design elevations.
   d. Quantity computations used for estimating fill volume, costs, or determining seeding areas.
   e. Vegetative specification.
   f. Engineering job class should be marked on plans.
   g. Construction Notes to clarify or give direction and which Minnesota Construction and Material Specifications apply to this job.
   h. Underground utility statement.
   i. BMP's required for erosion control during construction.

   More complex jobs that involve other structural practices or a combination of practices will require more detailed drawings and data sheets.
3. The design of complimentary conservation practices shall be in accordance with the appropriate Practice Standards in Section IV of the Technical Guide.
4. Review with landowner/operator the design and O&M plans. Give him or her the MN-ENG-098, Utility Notice worksheet to complete.

Construction

A. Construction Layout

1. Check for underground and above ground utilities by field observation, MN-ENG-098 completed by landowner, site visit checklist, and contractor notification of Gopher State One-Call (GSOC). Verify the GSOC ticket number provided by the contractor.
2. Review with the landowner the contractor list, bids, and estimate cost.
3. For many WASCB's and terrace jobs, the construction layout will be done at the same time as the design survey. The stakes used in the design survey can be used if they match your design and cuts, fills, or reference to inlet or outlet elevations can be marked on the stakes. Depending on your contractor, they will determine the amount of staking. Below is a guide of what the contractor needs to know from staking or otherwise to build it correctly.
   a. Gradient Terrace with waterway outlet.
      Contractor needs alignment, cross section, channel cut/fill, ridge fill, and where the terrace starts and stops.
      Contractor may need to know where to borrow fill, if there are any channel blocks, or are fills or cuts topsoiled.
   b. Gradient terraces or WASCB's with underground outlets.
      Contractor needs same information as above plus the size, location, and grade of tile outlets.
   c. Needs elevations or grade stakes of the intake especially if it is critical to the storage or the operation of the system as designed.
4. For guidelines on the layout of complimentary conservation practice installations refer to the appropriate Minnesota Engineering Procedure.
5. Review design, plan, specifications, and staking with the contractor.

B. Construction Inspection

1 The National Engineering Manual, Part 512 contains NRCS policy on the various aspects of construction inspection activities.
2. Inspection personnel with proper approval authority will inspect construction to the fullest extent possible, especially work that is not readily observed after installation.
3. Inspection personnel must be sensitive to developments during construction that are different from the assumptions made in the design. When these developments occur, the individual with the proper design approval authority will evaluate the conditions and make any adjustments necessary to the drawings and specifications. If changes are made, they are to be recorded on the as-built plans with documentation of proper approval authorizations.
4. Critical items such as concrete placement, underground drains, and backfilling of conduits require continuous inspection. Earth fills may require additional inspection and testing depending on compaction specifications.
5. Inspection plans will be considered for work that includes these critical items or for work where the estimated cost exceeds $50,000.
6. Field notes and check notes made during construction will be kept as part of the performance check documentation records. As much checking as possible will be done during construction so errors may be corrected before completion.
7. Contractors should be encouraged to make construction checks. Contractor training sessions may be required to maintain satisfactory levels of documentation and technical competence.

After Construction

A. Checking

1. Make visual inspection of complete terrace or basin.
2. Record channel and ridge checks and checkout cross section on worksheet MN-ENG-46 when it was used for design and construction layout. Field checkout notes can be used by following format in TR62, Figure 2-4, sheet 3 of 3.
3. Record profile shots of the channel and ridge at 100-foot stations for at least one terrace or WASCB for each group checked in each field. Take at least one cross section of each terrace or WASCB profiled. By visual inspection, the one profiled should be the one that appears least likely to meet specifications. The inspector doing the checkout needs to check the minimum amount noted above and as many more until he feels confident that all the work meets specification.
4. Check the land slope and vertical or horizontal interval for the terraces that were profiled and cross sectioned.
5. For storage terraces or WASCB's, check the storage area with a cross section that can be compared to a design survey cross section of the storage area.
6. Check adequacy of outlets, protection of inlet risers, and outlet animal guards. Make a statement or take elevation shots to assure compliance with plans.
7. Record length of each completed terrace and WASCB and method of measurement.
8. Record seeded area and observations on condition and adequacy of vegetation on areas requiring this protection. Seeding must be done prior to certification.
9. Certification statements must state that the practice meets or does not meet NRCS Standards and Specifications, be signed and dated. Certifications can be made on worksheet MN-ENG-46, on the checkout notes or drawings if it contains the above noted statement.
10. For guidelines on the checking of complimentary conservation practices, refer to the appropriate Minnesota Engineering Procedure.
11. Look for any unusual wet spots that may indicate crushed tile.

B. As-built Plans

1. As-built plans are to be prepared for all major structural (Class V and greater) works of improvement. As-built plans for minor (Class I-IV) structures are to be prepared as determined by the person having job approval authority. See NEM 512.52 regarding as-built documentation.
2. Any changes made during construction to the original design should be documented in the design folder and approved by the person with the design approval authority.
3. For guidelines on the as-built plans of complimentary conservation practices, refer to the appropriate Minnesota Engineering Procedure.

C. Minimum Documentation to be included in Case File

1. Design folder including survey notes and prepared drawings.
2. A list of applicable construction and material specifications, and construction notes.
3. Worksheet MN-ENG-098, Utility Notice and the GSOC ticket number verification.
4. Seeding, fertilizing and mulching plan and certification or observation statement on condition or adequacy of vegetation or compliance with recommended plan.
5. Operation and maintenance plan and inspection plan (if developed).
6. Checkout survey field notes and any calculations of quantities for payment items. Include as-built plans and completion reports if they were required.
7. Form CPA-052 Cultural Resources.